§MO541.00 Standard detail drawings.

(h) All drawings used repetitively in preparation of construction plans are considered standard drawings. These drawings shall be approved by the state conservation engineer and shall have drawing numbers and dates of issue.

(1) Standard drawings are on file in the Missouri Standard Drawings Handbook.

(2) All standard drawings in this handbook were drawn using AutoCAD.

(3) All Missouri standard drawings are available on the internet.

(i) All complex structural standard drawings shall be accompanied by a design folder. The design folder will be on file with the designer of the standard drawing and the State Conservation Engineer. The design will be checked by an engineer with the appropriate level of expertise, which is normally the State Design Section. Approval will be by state conservation engineer.

(1) Complete Structural Standard drawings require design analysis in order to size critical components. Load computations, foundation conditions, and strength of materials are examples of design parameters that may be used to develop a structural standard drawing.

(2) For details developed in other states, the design folder will be on file in that state.

(j) The state conservation engineer will approve the issuance of standard drawings to all field offices. Prior to issuance all standard drawings will be reviewed by the appropriate field engineers.

(k) Field staff may have local standard drawings. If these drawings are used extensively they may be submitted to state conservation engineer for approval as a standard drawing. These drawings will be checked, reviewed and issued like other standard drawings.

(ℓ) Use of Missouri standard drawings.

(1) Structural standard drawings shall not have structural features modified without approval from an individual with the appropriate level of approval authority. This is normally the person who prepared the standard drawing or analyzed the structural features. The drawing can be tailored to the particular installation as long as the structural features are not modified. The person approving the construction plans is responsible for any changes made to standard drawings.

(2) A Missouri Structural standard drawing that is modified shall have a note added stating that it was modified along with the date and name of the person approving the changes. This is not needed if the modifications were only to fill in the blanks on the drawing or delete non-applicable items.

(3) All other drawings can be modified to meet the needs of the particular application. The person approving the construction plans is responsible for any changes made to the drawings.

§MO541.01 Media and technique.

(c) Most field engineering offices have Computer Aided Design and Drafting (CADD) systems. In the future this capability may be expanded to include more offices. These offices have the capability to use and develop electronic drawings.

(d) New electronic drawings are to be developed using Missouri NRCS CADD Standards as outlined in CADD Note 5 or equivalent. This will ensure a consistent format and allow easy revision.

(e) Existing field generated standard drawings that are converted to an electronic drawing will be submitted to the State Conservation Engineer for checking, final approval and distribution.

§MO541.02

(a) Drawing sizes and sheet sizes shall be as follows:

(1) Current NRCS standard drawing E size (21" × 30"), N size (10 ½" × 15"), or L size (8 ½" × 11"). See NEM 541.20(a) and 541.21(a).

(2) Industry standard drawing D size (22" × 34") or B size (11" × 17"). NEM 541.20(b) and 541.21(b) give the dimensions of the borders and layout for the title block for these two sizes.

(b) Drawing sizes should be as consistent as possible within a set of construction plans.

§MO541.10 Class VI-VIII Jobs meeting TR-60 – Drafting and Plotting Engineering Surveys

(a) In addition to the requirements shown in §541.00 through §541.09, the drafting and plotting of engineering surveys for Class VI-VIII structures shall be in accordance with §MO541.11 and §MO541.12.

(b) In order to expedite the preparation of construction drawings for structures designed in the Design Section, detail drawings prepared in the field will be utilized by the design engineer insofar as possible. Full use of detail survey drawings for this purpose will require that proper scales be selected in the preparation of the drawings, and that accuracy be maintained in their preparation. It is important that the proper pencil be used in preparing the drawings. Lines on drawings submitted to the Design Section should be heavy enough that they can be traced easily through average weight tracing paper. In no case will both pencil and ink be used on a drawing to be incorporated into final plans. All notes will be lower case letters with normal capitalization. It is preferred to prepare drawings in a computer aided drafting program (CAD).

(c) The plotting of survey data is divided into two parts: Field Drawings for Design and Drawings for Geologic Investigations. In general, any information shown on the plans and profiles for Geologic Investigations will not be duplicated in the data prepared on the Detail Field Drawings. The survey data is to be plotted as detail field drawings.

§MO541.11 Class VI-VIII Jobs meeting TR-60 – Field Drawings for Design.

Detailed field drawings shall be prepared on plain or cross section tracing paper (21" x 30" sheets). Normally, two standard size sheets will be sufficient for a single structure on which the following are plotted:

(a) General Plan of Reservoir. This plan can normally be traced from the topographic map. Recommended scales are 1" = 100', 1" = 200' or 1" = 400'. The plan should be drawn with the direction of stream flow from left to right on the sheet and should include: (See exhibit §MO541.22)

(1) Land ownerships.
(2) The alignment of the embankment, auxiliary spillway and principal spillway.
(3) Reservoir contours and elevations at top of sediment or permanent pool and auxiliary spillway crest.
(4) Area covered by timber to be removed.
(5) Physical features such as buildings, wells, roads, fences, pipelines, utility lines, underground cables, etc.
(6) Approximate work limits.
(7) Bench mark locations and descriptions.
(8) Note describing structure locations.
(9) Show a section corner or center.
(10) The data table will include drainage area in acres, volumes of sediment or permanent and retarding pools in acre feet and surface areas of sediment or permanent and retarding pools in acres.

(b) Plan of Embankment and Spillways. This sheet will be used by the design engineer to develop the final construction plan of the embankment and auxiliary spillway. The field engineer should show all pertinent design information on this sheet (See Exhibits §MO541.23). The recommended scales are 1" = 50' or 1" = 100'. Data obtained during cross section survey of the embankment, auxiliary spillway, principal spillway and stream channel and/or during the topographic survey will be plotted on this sheet. This plan view will be drawn with the stream flow toward the top of the sheet and should include:

(1) The topography of the area, including the location of drainage channels and contour lines on 4 foot vertical intervals or less. Except contour lines on 2:1 or steeper slopes may be placed on 8 foot vertical intervals.

(2) The embankment plan, including centerline, crown width, and, when possible, berm locations and width, dike locations and toe of slope lines. If the embankment includes a curve, the curve data should include I-intersection angle between the two tangents, R-radius, T-length of tangent, L-length of curve and D-degree of curvature. Bench mark locations should be shown.

(3) The principal spillway location and alignment, showing the station tie and angle at the intersection formed by the centerlines of the dam and the principal spillway.

(4) The auxiliary spillway plan, including the centerline alignment, the bottom width and slope lines of the spillway. The station tie between the auxiliary spillway and the centerline of the embankment should be shown. If the spillway plan includes a curved section, the curve data should also be shown. This data should be the same as for item (2) above. Tracing paper overlays of the auxiliary spillway field design are recommended.

(5) The fences, if any, to enclose the embankment and spillway areas with the gate locations, type and size.

(6) Protective measures for the protection of the embankment, auxiliary spillway, borrow area and principal spillway outlet channel from outside drainage. These should include diversions, waterways, channels, dikes and other measures needed to protect the works of the improvement. Protective measures for the borrow area above the crest of the principal spillway should be shown on the NRCS-35A sheet.

(7) Physical features such as existing buildings, wells, fences, pipelines, utility lines, underground cables, etc.

(c) Cross sections. The cross sections should be plotted when it is impractical to put all the cross section details on the plan of embankment and auxiliary spillway(s) work sheet. The cross sections should be plotted on NRCS-315 or equivalent. The scales used must be clearly indicated on the plotted sections or sheet.

(1) Embankment – The scales for plotting will depend upon the maximum dam height. Use 1 inch = 10 feet vertical and 1 inch = 20 feet horizontal on dams up to 40 feet high. For higher dams, use 1 inch = 20 feet vertical and 1 inch = 50 feet horizontal. All embankment cross sections for any one structure should be plotted to the same scale. The sections should be spaced so the planned embankment and core may be drafted on each section.

(2) Principal spillway and outlet channel – Use 1 inch = 10 feet vertical and 1 inch = 20 feet horizontal scales. The sections should be placed so the planned spillway and/or channel may be drafted on the sections.

§MO541.12 Class VI – VIII Jobs meeting TR-60 – Drawings for Geological Investigations.

In general, any survey information shown on these drawings will not be duplicated in the data submitted for design. The drawings are to be prepared with pencil in adequate form so that reproduction can be made. The forms shown below may still have SCS logo on them.

(a) Arrangement. Standard forms NRCS 35A, B, and C or equivalent should be used for plotting the drawings for geologic investigation. The arrangement of the data to be plotted will be indicated by the printed titles on the forms.

(1) NRCS-35A – Plan of dam, auxiliary spillway, and borrow area(s). Geologic cross sections of borrow areas. (See Exhibit §MO541.24 for example).

(2) NRCS-35B – Profile and geologic section; centerline of dam profile; centerline of principal spillway. Cross section of stream channel(s). (See Exhibit §MO541.25 for example).

(3) NRCS-35C – Geologic cross sections of auxiliary spillway. Profile: Centerline of auxiliary spillway. (See Exhibit §MO541.26 for example).

(4) NRCS-315 – Cross sections of auxiliary spillway, cross sections of borrow grids, and profile of foundation drain shall be plotted on standard form NRCS-315 or equivalent. (See Exhibit §MO541.27 for example).

(b) Plan of dam, auxiliary spillway, and borrow area(s). This plan can be traced from the topographic map if it is of the proper scale. The scale depends on the distance borrow will be needed upstream from centerline of dam. The borrow area grids can extend to the bottom of the NRCS-35A sheet by erasing the divider line. The borrow grids should be spaced a minimum of 100 feet and a maximum of 200 feet depending on the complexity of the borrow material. The size or shape of a project may make it advantageous to show the auxiliary spillway outline separately. Recommended scales are 1 inch = 50 feet, 1 inch = 100 feet, and 1 inch = 200 feet. The scale should be as large as possible, but still show all features in one integral plan view. The plan should include:

(1) Location of the centerline of the dam and principal spillway. Show the station tie and angle at the intersection formed by the centerline of the dam and auxiliary spillway.

(2) Auxiliary spillway to include the centerline, both outside edges, crest, significant stations and tie in with the centerline of the dam. The tie-in can be made on any line of the spillway that intersects the centerline of the dam. The concurrent stations and angle of intersection must be shown.

(3) Meanderings of the stream channel through the borrow, across the foundation of the dam, and beyond the principal spillway outlet channel showing the locations of the stream channel cross sections.

(4) Reservoir contours at the principal spillway crest and auxiliary spillway crest and any other contours necessary to show the topography.

(5) Physical features such as buildings, wells, roads, fences, pipelines, utility lines, underground cables, etc.

(6) Bench mark locations and descriptions.

(7) Note describing structure location.

(8) North arrow.

(c) Geologic cross sections of borrow area(s). Plot in consecutive order on separate sheet (NRCS-315) or equivalent. Leave sufficient vertical space between cross sections to plot the logs of borings to a depth of 14 feet. Recommended scales are 1 inch = 100 feet or 1 inch = 200 feet horizontal and 1 inch = 10 feet vertical.

(d) Profile and geologic section: centerline of dam. In addition to the natural ground surface, the profile should include:

(1) Principal spillway crest elevation.
(2) Auxiliary spillway crest elevation.
(3) Settled top of dam elevation.
(4) Relation with the auxiliary spillway.

(i) Where the centerline of the dam intersects the crest section of the auxiliary spillway and the spillway centerline is perpendicular to the centerline of the dam, the auxiliary spillway cross section should be shown as a continuation of the embankment profile.

(ii) Where the centerline of the dam intersects the auxiliary spillway upstream or downstream from the auxiliary spillway crest, the embankment profile should end at the inside edge of the spillway.

(5) Recommended scales are 1 inch = 50 feet or 1 inch = 100 feet horizontal and 1 inch = 10 feet vertical.

(e) Profile: centerline of principal spillway. This profile should start 100 feet upstream of the toe and extend past the discharge end of the conduit and along the outlet channel and down the stream bed a sufficient distance to determine the stream gradient. Recommended scales are 1 inch = 50 feet horizontal and 1 inch = 10 feet vertical.

(f) Cross sections of stream channel(s). Channel sections should be shown when stream channel cleanout or bank sloping will be required. All cross sections should show bottom width, slopes on top of stream bank and the natural ground line approximately 25 feet on each side of the stream channel. Plot in consecutive order and show the distance between adjacent cross sections as measured along the stream channel. In plotting, leave sufficient vertical space to permit plotting the logs to a depth of 6 feet. If additional space is needed, use the same method previously outlined for plotting borrow area cross sections. Recommended scales are 1 inch = 10 feet or 1 inch = 20 feet, depending on the size of the channel and space limitations.

(g) Profile: centerline of auxiliary spillway. This profile should start at the beginning of the entrance channel and extend downstream to the ditch bottom or to a stable grade. Recommended scales are 1 inch = 50 feet or 1 inch = 100 feet horizontal and 1 inch = 10 feet vertical.

(h) Auxiliary spillway cross section. The cross sections will not be placed on the NRCS-35C sheet in the field. Instead, they will be plotted together as a separate unit, on NRCS-315 or equivalent. Recommended scales are 1 inch = 10 feet vertical and 1 inch = 20 feet horizontal up to 100 foot bottom width. For wider bottom widths use 1 inch = 50 feet horizontal scale. For more complex sites, such as those involving rock or waste material, the recommended scales may need to be adjusted. The sections should be spaced so the planned spillway may be drafted on each section.

DATA TABLE	
Drainage Area, Acres	5800
Permanent Storage, Acre Feet	476
Retarding Storage, Acre Feet	1550
Permanent Pool, Acres	67
Retarding Pool, Acres	162

(Example for Grade Stabilization Structure)

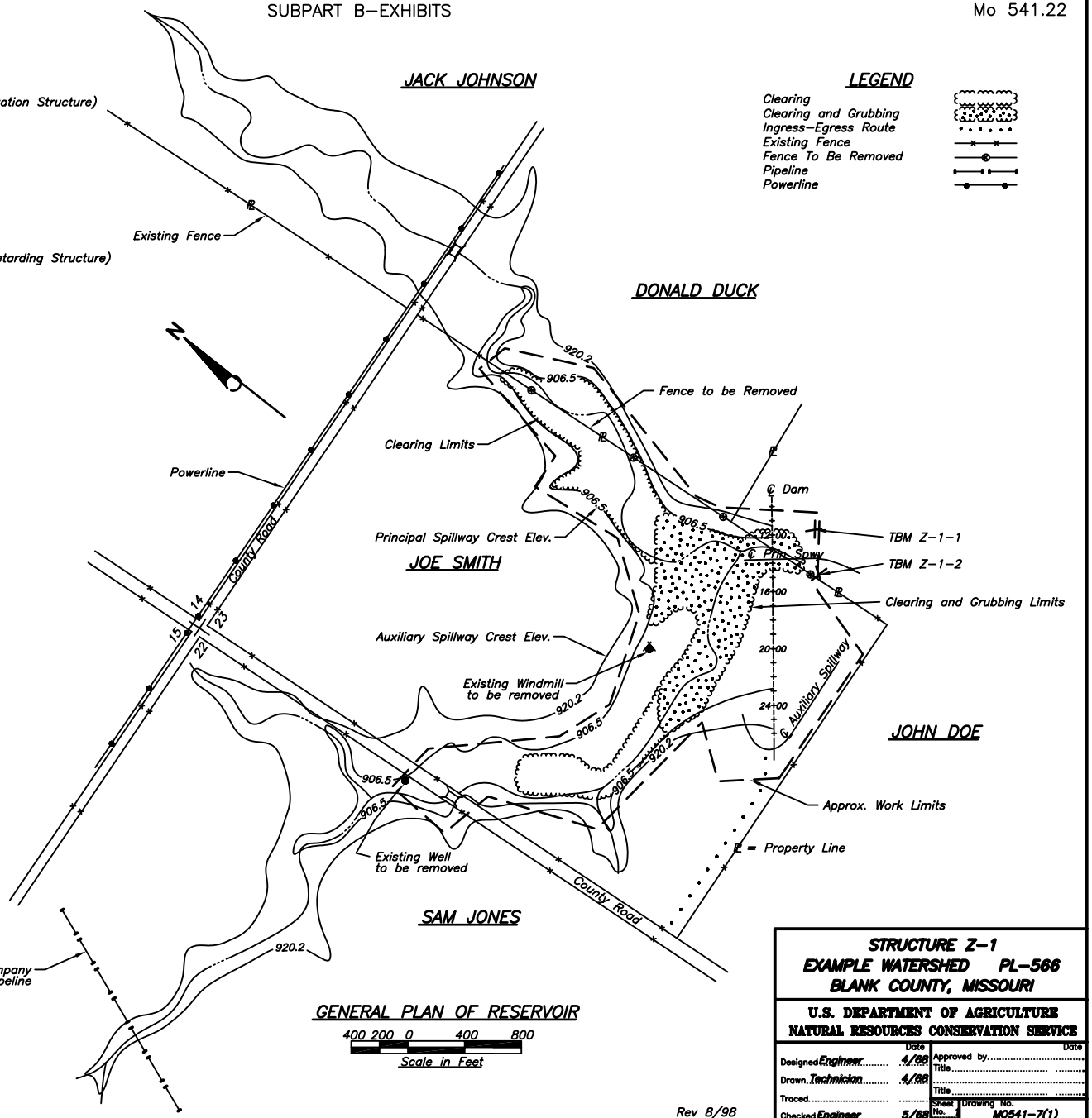
DATA TABLE	
Drainage Area, Acres	5800
Permanent Storage, Acre Feet	476
Retarding Storage, Acre Feet	1550
Permanent Pool, Acres	67
Retarding Pool, Acres	162

(Example for Floodwater Retarding Structure)

TBM Z—1—1 Elev. 911.25 60d spike in West side of 8' diam. Locust tree, approx. 290 feet left of Sta. 11+65 ℄ Dam

TBM Z—1—2 Elev. 885.17 60d spike in N—S fence line approx. 320 feet left of Sta. 15+25 ℄ Dam.

Structure Z—1 located approx. 9 miles East of Anytown, Missouri in N—W 1/4 Sec. 23, T. 49 N R 18 W.



QUANTITIES

Clearing — — — — — — — — — Lump Sum
(Approx. 20 Acres)

Clearing and Grubbing — — Lump Sum
(Approx. 18 Acres)

GENERAL PLAN OF RESERVOIR

400 200 0 400 800
Scale in Feet

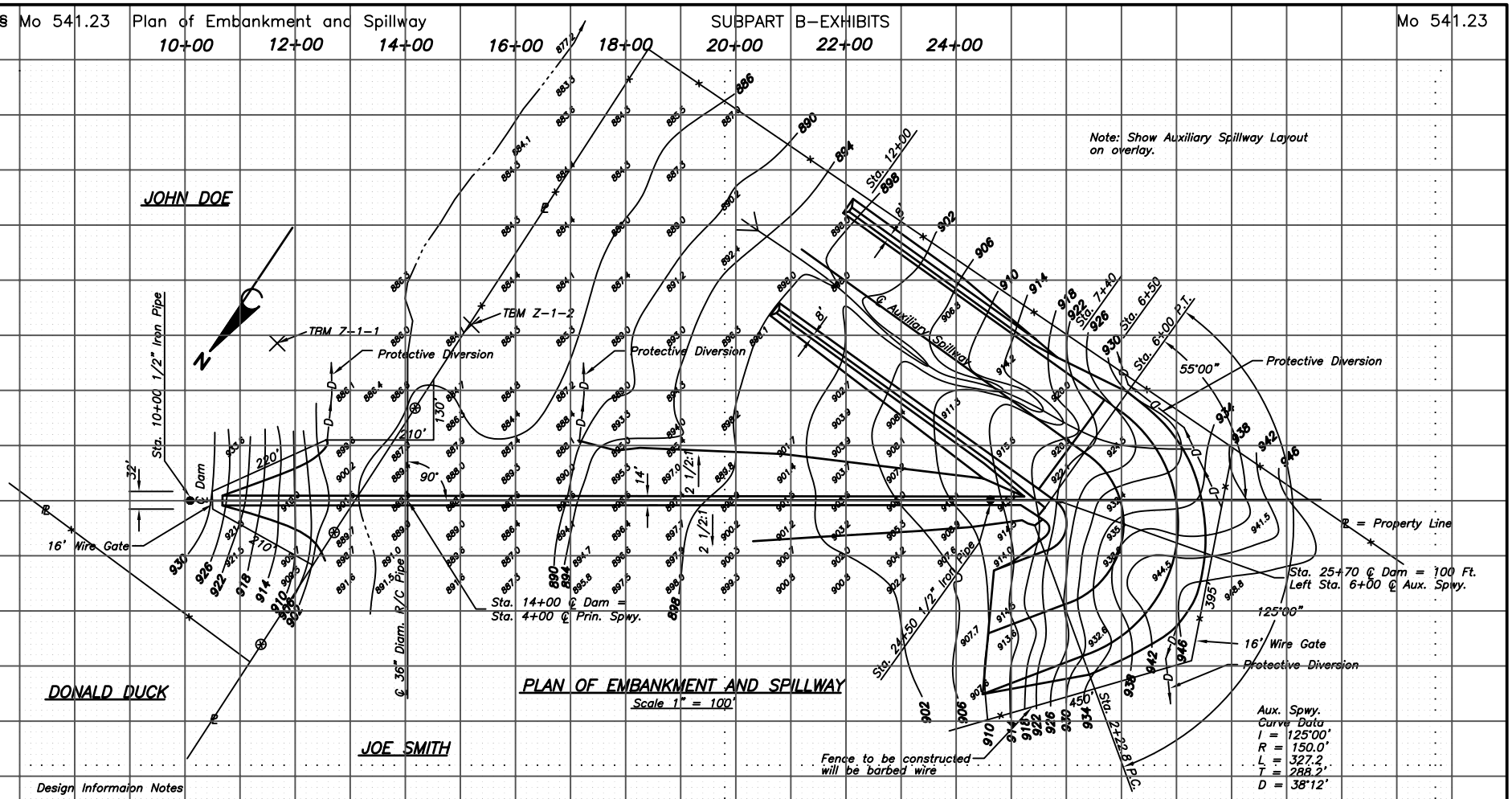
Rev 8/98

STRUCTURE Z—1
EXAMPLE WATERSHED PL—566
BLANK COUNTY, MISSOURI

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

	Date		Date
Designed Engineer	4/98	Approved by	
Drawn Technician	4/98	Title	
Traced		Title	
Checked Engineer	5/98	Sheet No. 1 of 6	Drawing No. MO541—7(1)

ACAD MO541—71.DWG



PLAN OF EMBANKMENT AND SPILLWAY

Scale 1" = 100'

Fence to be constructed will be barbed wire

Design Information Notes

1. Downstream berm to be approx. elev. 893.0 at Sta. 14+00 with a 1% grade down to the right.
2. Riprap is recommended for the upstream face of the dam due to the size of the pool (67 AC) and fetch (N-W 5200'±)
3. Topsoil will be needed in the auxiliary spillway to establish vegetation.
4. Protective Diversion will be needed as shown.
5. Hard durable riprap material conforming to the following gradation is available at the Green Giant Quarry, located 10 miles from the site.

Piece Size Lbs.	% Total Number Pieces
Over 650	0
161-650	15-35
81-160	40-60
11-80	10-20
0-10	(Less than 10% Total Quantity by Weight)

6. The North-South county road is to be raised
9. Elevations

Top of Dam	927.0
Aux. Spwy. Crest	920.2
Prin. Spwy. Crest	906.5

10. The upstream berm(s) was not shown since the exact layout of the riprap was not known.

Je filled with earth fill.

STRUCTURE Z-1
EXAMPLE WATERSHED PL-566
BLANK COUNTY, MISSOURI

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

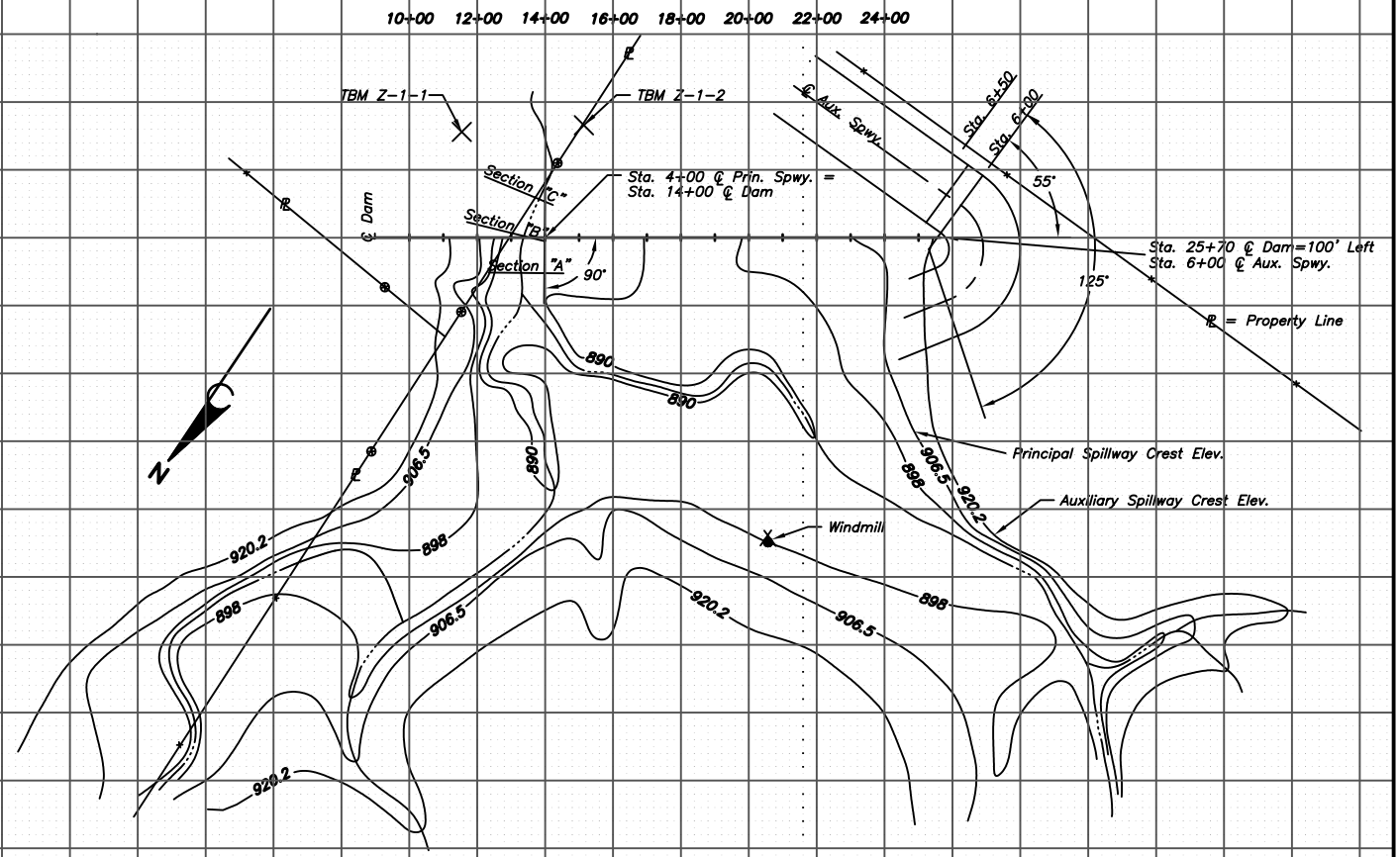
	Date		Date
Designed N.E.D.	4/98	Approved by	
Drawn R.A.Y.	4/98	Title	
Traced		Title	
Checked		Sheet No. 3 of 6	Drawing No. MO541-7(2)

Rev. 8/98

ACAD MO541-72.DWG

§ Mo 541.24 SCS–35A

SUBPART B–EXHIBITS



TBM Z–1–1 Elev. 911.25 60d in west side 8" diam. Locust tree, approx. 290' left of Sta. 11+55 ℄ dam.

TBM Z–1–2 Elev. 885.17 60d spike in N–S fence line approx. 320' left of Sta. 15+25 ℄ dam.

Structure Z–1 located approx. 9 miles east of Anytown, MO in N–W 1/4 Sec. 23, T. 49 N, R. 18 W.

PLAN OF DAM, AUXILIARY SPILLWAY AND BORROW AREA(S)

NOTE: Plot Grids on SCS–315

GEOLOGIC CROSS SECTIONS OF BORROW AREA(S)

Rev. 9/98

LEGEND Mo 541.24

SYMBOLS

UNCONSOLIDATED MATERIAL

gravel; sand; silt; clay; cobbles, boulders
gravel, sandy; sand, gravelly; silt, gravelly; clay, gravelly; peat or muck
gravel, silty; sand, silty; silt, sandy; clay, sandy
gravel, clayey; sand, clayey; silt, clayey; clay, silty

CONSOLIDATED MATERIAL

Sedimentary Rocks

conglomerate Cng.; shale sh.; limestone ls.; coal
breccia brc.; siltstone slst.; dolomite dol.; gypsum gyp.
sandstone ss.; marl; chalk ck.; chert ckt.

Metamorphic Rocks

gneiss; schist

Igneous Rocks

intrusive; extrusive
quartzite; slate; pyroclastic
marble; soapstone talc serpentine

Undifferentiated

Other Symbols

hole logged only; hole sampled; strike and dip; pit or trench; pit sampled

ABBREVIATIONS

ang.	angular	lam.	laminated	G	gravel, gravelly
bld.	boulders (>12")	los.	loose	S	sand, sandy
calc.	calcareous	mas.	massive	M	silt, silty
cali.	caliche	med.	medium	C	clay, clayey
cav.	cavities	mic.	micaceous	O	organic
cmt.	cemented	mod.	moderately	W	well graded
ces.	coarse	n.r.	no recovery	P	poorly graded
cbl.	cobbles (3"–12")	per.	permeable		
cpt.	compact	po.	poorly		
con.	concretione	rnd.	rounded		
cn.	crystalline	sl/.	slightly		
de.	dense	sft.	soft		
dip.	dipping	s/.	some		
d.s.	downstream	slo.	slowly		
fn.	fine	stf.	stiff		
frm.	firm	t.b.	thin–bedded		
frac.	fractured	tuff.	tuffaceous		
frg.	fragments	u.s.	upstream		
fr.	friable	var.	variable		
grn.	grain	v/.	very		
ggs.	gypsiferous	wea.	weathered		
hd.	hard	w/.	with		
hr.	highly	w.l.	(date) static water level		

TEST HOLE NUMBERING SYSTEM

Centerline of dam	1–99	Stream channel	401–499
Borrow area	101–199	Relief wells	501–599
Emergency spillway	201–299		601–699
Centerline of outlet structure	301–399		701–799

UNIFIED SOIL CLASSIFICATION SYSTEM SYMBOLS

GW	Well graded gravels; gravel–sand mixtures
GP	Poorly graded gravels
GM	Silty gravels; gravel–sand–silt mixtures
GC	Clayey gravels; gravel–sand–clay mixtures
SW	Well graded sands; sand–gravel mixtures
SP	Poorly graded sands
SM	Silty sand
SC	Clayey sands; sand–clay mixtures
ML	Silts with liquid limit of 50 or less
MH	Silts with liquid limit above 50
CL	Clays with liquid limit of 50 or less
CH	Clays with liquid limit above 50
OL	Organic silts and clays with liquid limit of 50 or less
OH	Organic silts and clays with liquid limit above 50

Revised February 1983

PLAN AND PROFILES FOR GEOLOGIC INVESTIGATIONS

STRUCTURE Z–1

EXAMPLE WATERSHED PL–566

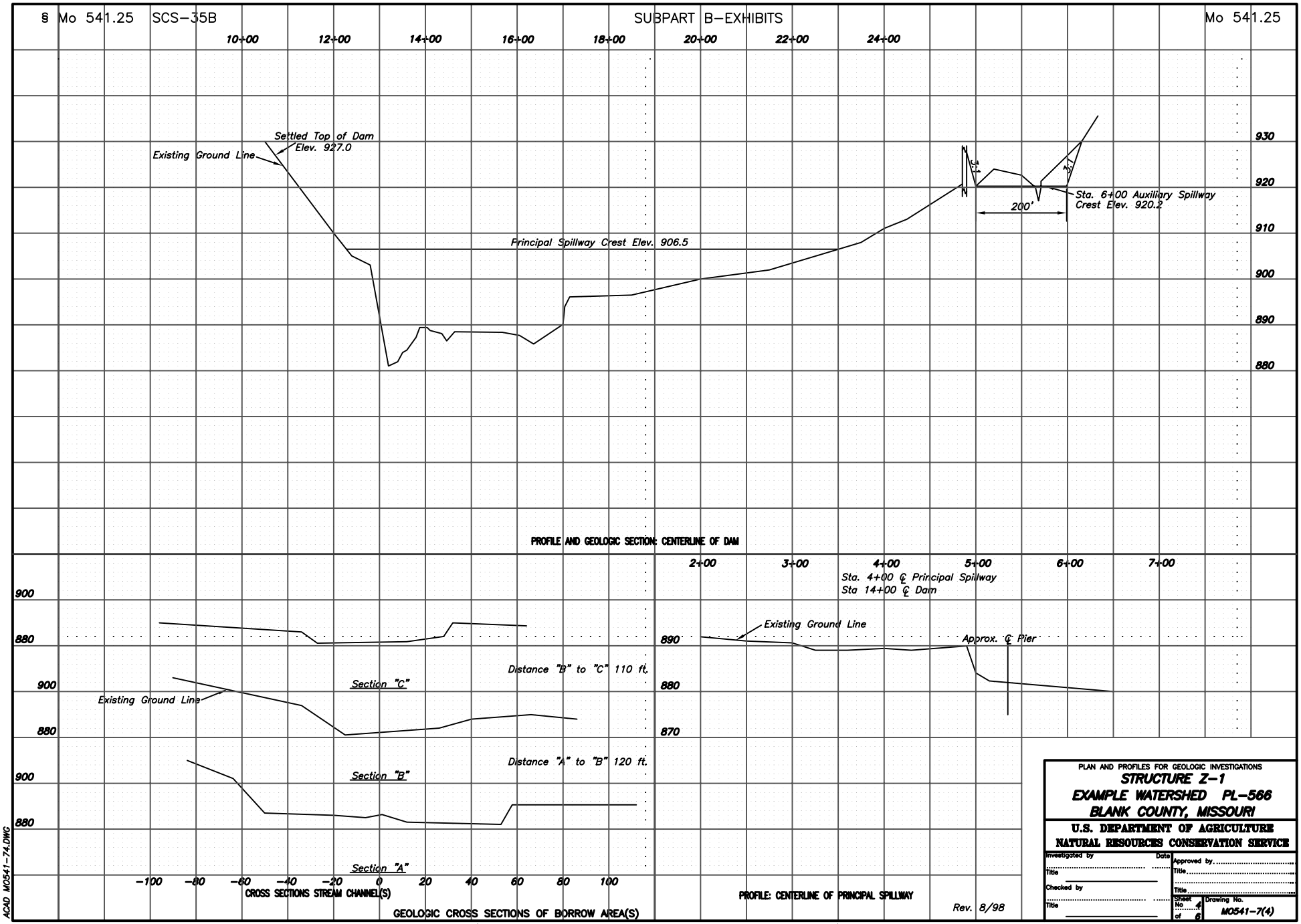
BLANK COUNTY, MISSOURI

U.S. DEPARTMENT OF AGRICULTURE

NATURAL RESOURCES CONSERVATION SERVICE

Investigated by ..... Date	Approved by .....
Title	Title .....
Checked by	Title .....
Title	Sheet No. ..... 7 of 8 — Drawing No. M0541–7(3)

ACAD M0541–73.DWG



PLAN AND PROFILES FOR GEOLOGIC INVESTIGATIONS

STRUCTURE Z–1

EXAMPLE WATERSHED PL–566

BLANK COUNTY, MISSOURI

U.S. DEPARTMENT OF AGRICULTURE

NATURAL RESOURCES CONSERVATION SERVICE

Investigated by ..... Date .....
Title .....
Checked by .....
Title .....

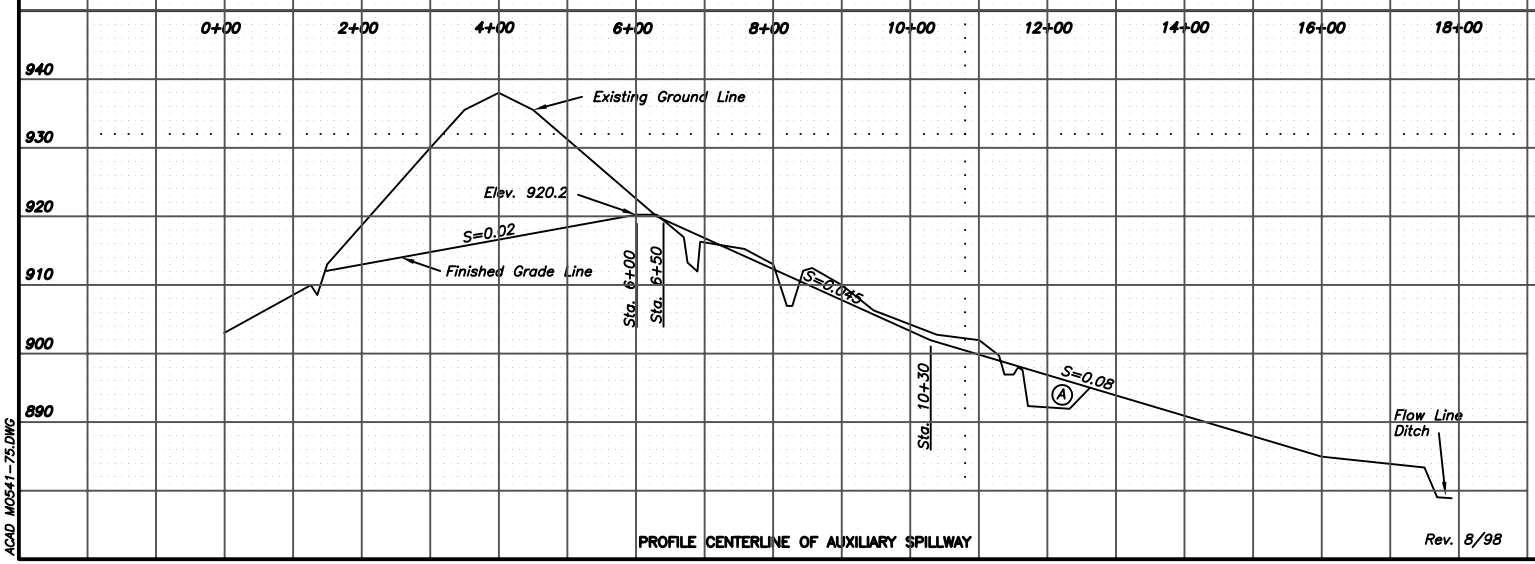
Approved by .....
Title .....
Title .....

Sheet No. 4 of 6

Drawing No. MO541–7(4)

ACAD MO541–74.DWG

GEOLOGIC CROSS SECTIONS OF AUXILIARY SPILLWAY



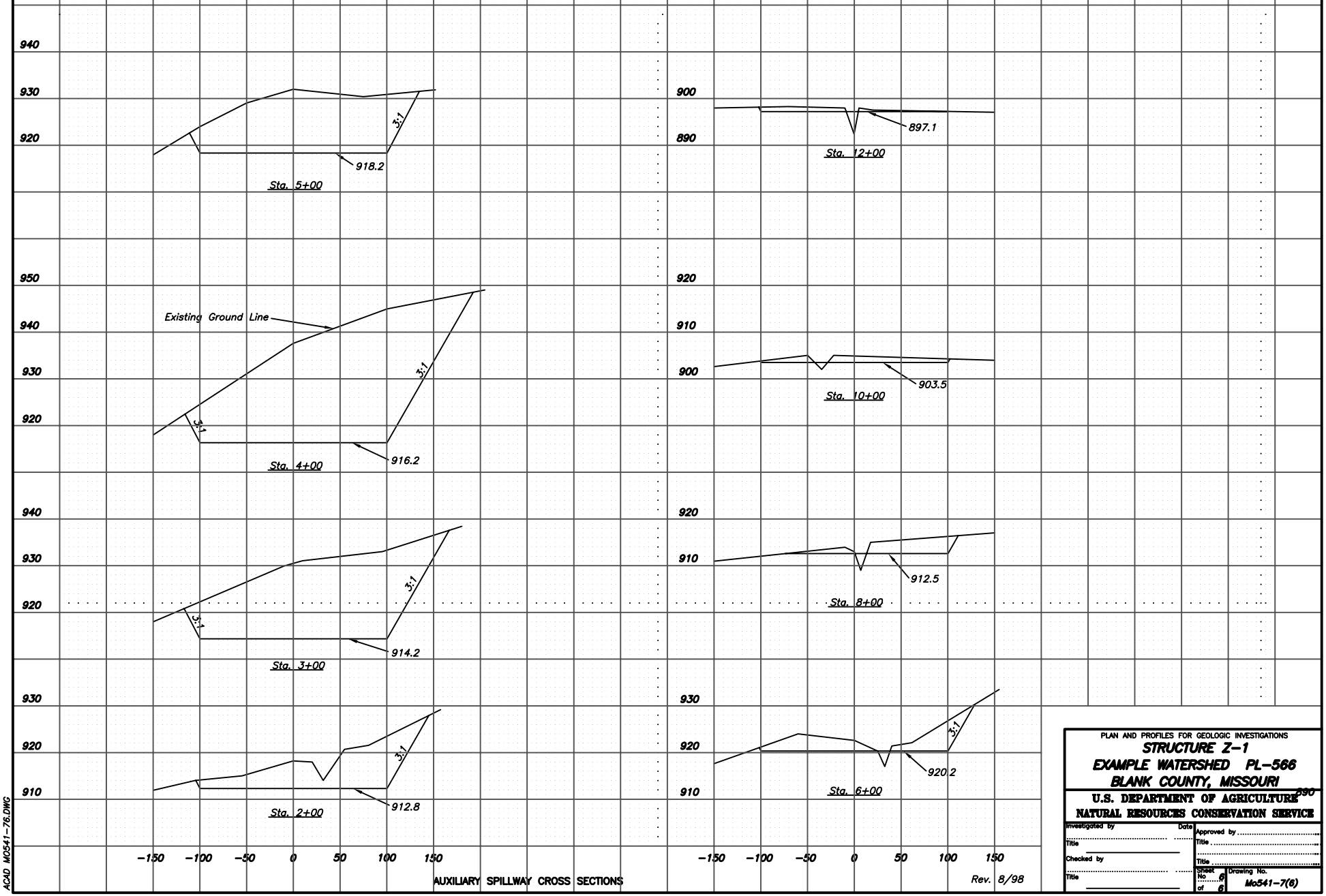
PROFILE CENTERLINE OF AUXILIARY SPILLWAY

Rev. 8/98

PLAN AND PROFILES FOR GEOLOGIC INVESTIGATIONS
STRUCTURE Z–1
EXAMPLE WATERSHED PL–566
BLANK COUNTY, MISSOURI
U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

Investigated by ..... Date .....
Title .....
Checked by .....
Title .....
Approved by .....
Title .....
Title .....
Sheet No. 5 of 6
Drawing No. MO541–7(5)

ACAD MO541–75.DWG



AUXILIARY SPILLWAY CROSS SECTIONS

Rev. 8/98

PLAN AND PROFILES FOR GEOLOGIC INVESTIGATIONS
STRUCTURE Z−1
EXAMPLE WATERSHED PL−566
BLANK COUNTY, MISSOURI
U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

Investigated by ..... Date .....
Title .....
Checked by .....
Title .....

Approved by .....
Title .....
Title .....

Sheet No. 6 of 6
Drawing No. Mo541−7(6)

ACAD MO541−76.DWG